



How to Organise Student Introductions to PBL

Note: These sample materials were developed from the UCM Student Introduction Materials and are included in the CREATES Toolkit Co-creative Learning as an example of how to organise student introductions to Problem-based Learning. For more information and additional educational tools, visit: <http://europe-creates.eu>

The goal of the manual at hand is to let students experience how to behave in a PBL environment. This manual is an extensive overview for tutors, with a manual for students at the end of it. The Problem-Task itself can be found under point 4.

In a short lecture on group learning, one may want to introduce students to the seven steps (see [CREATES Toolkit for Co-Creative Learning](#)), why these seven steps are so important (and, no matter the situation, will always pop up when solving problems with a group of others eager to learn), and the different roles people can have in a tutorial setting. Your role as a tutor is to be just that, a tutor. In addition, what is highly important when students study in a PBL environment for the first time, is feedback on their participation. Therefore, an essential part of the PBL training sessions is the evaluation. We provide you with some suggestions after each exercise on how to approach the evaluation. Remember: if we succeed in getting the message across, we will end up with a generation of students that are actually able to conduct proper (PBL) discussions, which would make our lives as tutors so much easier and pleasant!

The PBL training for students consists of several aspects, a PBL training tutorial and two lectures (one on group learning and one on the educational theory behind PBL).

In a tutorial group, guided by a tutor, students practice working with problems using the PBL-method. We will teach students how to participate in a tutorial group, the specific roles, and the steps to take when working with the problems. The booklet by Van Til and Van der Heijden that can be found in the [annotated bibliography](#) contains additional information on the PBL-method.

The following consists of a manual for teaching staff and the printed information to be handed out to the students:

1. Overview about the organisation
2. Information on lecture about group learning
3. Information on lecture on educational theory
4. PBL-discussion: Teaching or learning
 - a. The pre-discussion (Step 1-5); Includes the sample problem description
 - b. Critical moments: Information for tutors
 - c. Individual Study (Step 6)
 - d. The post-discussion (Step 7)
 - e. How to evaluate the discussion
5. Materials for students

1. Staff Materials / Materials for Teaching Assistants

The training includes three elements:

PBL training session

In tutorial groups, the students study a problem about the differences between a traditional, lecture-based educational system and the PBL system. A 1-hour pre-discussion of the problem is followed by a 1.5-hour individual study session. Students receive a set of articles they can use to answer your learning goals. In a 1-hour post-discussion, they discuss their findings with the group. The lectures, too, could be used as information for the post-discussion if they are placed between the pre- and post-discussion.

Lecture on group learning

In a short lecture, we introduce students to the concepts of group learning, which helps you to take your first steps in PBL, before students dive into the PBL task.

Lecture on Educational Theory

By giving students a look behind the scenes, we introduce them to the educational theory underlying PBL. This information takes place after the pre-discussion and thus serves as input for the post-discussion.

More detailed information will be provided below.

2. Lecture on Group Learning

This lecture takes place before the pre-discussion and is concerned with the following:

PBL has three parts: 1) the realisation that all life is problem solving; 2) the best way to approach these problems is in company and with the help of others eager to learn; and 3) the realisation that if you end up in a group that has to achieve an outcome in a limited time that whichever way you turn it you will go through some version of the seven steps.

The first part, the realisation that all life is problem solving translated to PBL, means that problems or tasks are ill defined. In tutorials, problems or tasks mark the starting point of the learning process. Tasks may vary in their form, structure, and presentation. You may be confronted with case descriptions, the presentation may be a written or visualised description of a situation, a graph, or a picture, it may be in the form of a conversation, or quotes from a newspaper article. But no matter the form, a well-written PBL-task does not immediately and conclusively give away what problem needs to be discussed; that is, the problem is ill-defined.

The second part means that the success of a tutorial can only be achieved if every member of the group is prepared to contribute something towards it. You need the requisite listening skills, critical thinking skills, commitment to a group product in terms of learning objectives, etc.

Problem-Based Learning means that although much of the work has to be done on your own, you will also be working with other students. It both recognises and highlights the interactive or collaborative aspects of learning: sharing resources, new ideas for explaining the problem at hand, suggesting alternative resources, which you may have overlooked on your own, are all examples of learning from and with each other.

The third part is the realisation that the seven steps are the self-evident consequence of any attempt to work in a group in a productive way. When discussing with friends or peers, you quickly realise that without having a clear sense of what the concepts are that are being used in a discussion (*step 1. clarifying unclear terms and concepts*), or without a clear sense of the topic of discussion (*step 2. defining the problem*), the discussion is by no means constructive. It is impossible to efficiently achieve a clear outcome if the participants do not share the knowledge they have on the topic already, or if you have no idea about the others' perspectives on a topic (*step 3 and 4. problem analysis: producing as many ideas as possible – brainstorm – and arranging the ideas systematically – clustering*).

In a group-learning process, the role of the group members and the way they act is important: drawing in others, making space for others. Students should realise that a tutorial group is a safe place where they can share their ideas, make mistakes, and ask for help and feedback, without any negative consequences. This is something they should be aware of during their time at university: the tutorial meetings should be useful for them. In case they feel that the way the tutorial functions does not work for them, we encourage them to bring that up in class.

3. Lecture on Educational Theory

The second lecture, which **takes place between the pre-discussion and the individual study**, introduces students to some educational theory. By giving them a peak behind the scenes, we hope to enlighten them on the learning theories that underlie Problem-Based Learning. The following is a summary of what this lecture may contain.

Knowledge is constructed, requires collaboration, begs for context and, accordingly, is self-directed (or self-evaluative).

- × Constructive: Knowledge is not a collection of loose facts and it does not come from nowhere. Knowledge acquisition is a process that requires construction. New knowledge is based on and builds up on prior knowledge.
- × Collaborative: Knowledge is not a matter of individual, subjective assessment. It is a matter of public scrutiny. A piece of knowledge in my mind is not knowledge until I put it out there for others to assess, contest, and critically evaluate. Not until you contribute a conjecture to a discussion or debate are you taking part in knowledge construction.
- × Contextual: Knowledge is not a collection of mere facts. Knowledge requires context. It is constructed in a context and thereby is part of a larger context. New bits of knowledge,

facts, require a place to land, a context, and this context is always an individual network of existing knowledge.

- × Self-directed/evaluative: When constructing new knowledge, it needs to be placed in the context of the individual's network of knowledge. The individual has to take charge in constructing that network and thus evaluate how the fact relates to the other, already present facts.

Learning is often identified with the encoding or acquisition of new information. As a result, the focus of many learners (and instructors) falls on processes involved in encoding new knowledge. Retrieval is merely considered an assessment of whether learning happened at all and what was learned. Retrieval processes as such are not typically thought to produce learning. But retrieval does enhance learning in significant ways: each act of retrieval changes one's knowledge, improving the ability to retrieve knowledge again in the future. Our memory works in peculiar ways: things are impressed better by active than by passive repetition.

Students are introduced to Bloom's taxonomy. In a tutorial, recalling facts (i.e. remember) does not lead to the construction of new knowledge. It may be good to spend a little time on this part of learning (retrieval practice), but should not last the full tutorial.

Constructing new knowledge happens at higher levels (related to course levels: 1000-level courses (should) aim at remembering, understanding, and applying; 2000-level courses (should) aim at understanding, applying, and analysing; 3000-level courses (should) aim at applying, analysing, and creating).

Remembering happens on an individual level, thus it has nothing to do with constructing new knowledge (which requires collaboration, context and self-evaluation). Only when you allow others to examine your creation, assess and scrutinize it, we can speak of the construction of new knowledge.

Does this mean that PBL (or CCCS – **C**onstructive, **C**ollaborative, **C**ontextual, **S**elf-directed) is the Holy Grail of education? Certainly not. The most important aspect of this educational method is that it stimulates **active learning** (versus passive learning in most lecture-based settings). Active learning requires the realization that retrieval is not just an assessment of whether learning happened. Retrieval is an active part of learning. When you retrieve knowledge, you also update the context associated with that knowledge, and the updated context is used to enhance subsequent retrieval. Certainly, this can also be done in lecture-based education. But then the initiative lies with the learner. The learner needs to set reminders for retrieval practice. In PBL, the retrieval process is something that happens automatically. In a well-constructed course, you will require and use knowledge constructed in the first problem when discussing possible solutions, and thus constructing new knowledge, for subsequent problems.

For many people, this is a counterintuitive practice. For many students, studying means reading a text over and over again. Studying once and then retrieving the studied materials, e.g. by discussing them in a tutorial, gives many the feeling that they are not sufficiently prepared for a test. However, several studies have shown that the opposite is true: one study period followed by three repeated retrieval periods yields better results than four repeated study periods. That is

why active learning in a PBL-environment pays off: retrieval is what happens in the tutorials, by constructing knowledge in the company of others. It does however require active participation from all members.

Important note

To make this venture a success, students have to claim ownership. It is important that we do not simply teach students to jump through seven hoops whenever they have a (PBL) discussion. The seven steps is not a trick. Students have to *use* their tutorials. Every individual is responsible for their own learning and for the necessary interaction in the tutorial group. They need to know how learning happens, they need to understand how they learn, and foremost, they need to realise that in order for them to learn, they need others, because knowledge is constructed in collaboration with others, allowing you to place the new information in your self-directed context. We should help students realise that only by following the seven-step approach will they be able to have constructive discussions and to tackle problems in a time-saving, systematic, and, most importantly, productive manner. We need to prepare students for group work skills and we need to train them in performing the roles that help groups move smoothly over difficult terrain: chairmanship, participation skills, note-taking skills, and the toolbox of interventions like summarising, paraphrasing, etc.

4. PBL-Discussion: Teaching or Learning

This session will take 1.5 hours. This pre-discussion is the start of a full round of PBL. Students are expected to do one full pre-discussions (step 1-5) of approximately 1 hour. It is important that students make an effort to thoroughly discuss and answer the learning goals they formulate.

NB. At the end of the pre-discussion, after formulating the learning goals, make sure to hand out the reading materials to the students.

4. a) The pre-discussion: Teaching or learning

(60 minutes – Student manual page 10)

Take some time to work out the set-up of this problem. Appoint a discussion leader and a note-taker. Before starting the discussion, ask the discussion leader in particular, but also the other group members, what they expect to find difficult when participating in a PBL discussion. These difficulties can be listed on the board as attention points, which should be reflected upon in the evaluation.

Problem description:

Teaching or learning

A group of 12 students, a mix of regular and exchange students, sitting around a large table. They all have a booklet in front of them, titled Course Manual Educational Sciences, and they are reading the first problem description. The tutor, who is also their professor, appears to be late, but that does not stop them from starting. These students clearly have a high level of intrinsic motivation. They are convinced of the fact that all life is problem solving and that the best way to approach these problems is in the company and with the help of others eager to learn. They all support the constructivist views on learning, an instructional method based on inquiry.

Their professor is a true scholar, in line with the definition of Ernest Boyer. There is a quote by Aristotle on the wall of her office stating: "Teaching is the highest form of understanding". Their professor has a true passion for research. Her problem descriptions appeal to the students, since they include applying theories to real-life examples and situations, which helps students to see how the things they learn are relevant for their future. Although the professor only rarely partakes in the discussion, she has a tendency to give meaning to isolated facts, putting them in perspective.

The day before the exam, the students enjoy a beer together at the market square of the city. One of the exchange students compares his experiences with PBL to the lecture-based instruction method at his home university. The students are interested in the opinion of their professor on this matter, and they invite her to join them. She is a bit surprised: "Should you not be studying for the exam?" Nope, not us; we are prepared for life!

Step 1: Clarify unclear terms and concepts: the problem invites students to discuss the pro and con arguments of PBL versus a traditional, lecture-based form of education.

Step 2: Define the problem: e.g., does a PBL environment help to better retain new information (as compared to traditional ways of education)?

Step 3 & 4: Problem analysis: the problem is supposed to trigger them to look for differences and similarities, advantages and disadvantages of both educational methods. The post-discussion (and thus the learning goals, and brainstorm) should entail more than a list of factors; students should be encouraged to formulate convincing arguments as to why PBL helps to retain newly acquired information or develop important competencies.

Step 5: Formulate learning goals: make sure the learning goals are formulated based on questions raised when analysing the problem. Possible learning goals:

- What are the characteristics of PBL? (students may want to make a comparison between PBL and a conventional lecture-based instruction)
- What is the constructivist view on learning?
- What does an instructional method based on inquiry imply?
- How can we define/ recognise a true scholar?
- Does PBL "prepare for life"? How so?

Notes

4. b) Critical moments

Some critical moments that may occur during the PBL discussions are listed below. Pay attention to these situations when they happen.

Running out of board space:

If the students have generated enough information during the brainstorm and clustering steps, they will probably run out of space on the board. Take a moment to restate the role of the note-taker. Mention a few things such as:

- × Students do not wait for the note-taker to write down comments; s/he keeps up with the group
- × The group first discusses the problem statement that will be used; only then does the note-taker write this down
- × Reserve space on the whiteboard beforehand for problem statement and learning goals
- × Write small enough and use only keywords initially
- × Do **not** erase information

Students with PBL experience:

Some students transferred from organisations where they already have experiences with PBL. They may claim to be used to a different style of PBL. It is not uncommon to hear things like:

“I have studied ...with PBL before and there we always took minutes/ we always divided the reading material/ we always went straight to the learning goals.”

If students come here from a different faculty they might be used to a different style of working; they have learned to jump through seven hoops, but they have no idea why they are taking

these steps. In case someone brings it up, refer back to the third part of PBL: the realisation that the seven steps are the self-evident consequence of any attempt to work in a group in a productive way (see page 11).

Vague, generalised learning goals:

Tutorial groups sometimes settle for vague, generalised learning goals. This requires each group member to interpret and reformulate the learning goals in their own way. Different members may study different things, and as a result, the post-discussion has no clear focus. This results in wasted time for group members, both during the tutorial and their individual studies. Force students to formulate the learning goals clear and precise, and double check whether all group members interpret the learning goals in the same way.

The passive student – not participating to the discussion:

Some students are present in the tutorial room, but do not actively take part in the discussion. Stress the importance of learning in small groups. Tutorial groups allow students to develop their communication and collaborative skills – skills that are likely to be important in their future job. It is an excellent setting to learn to work with other people, and learn something about the way you and others function within a group. Not taking active part in the discussion, results in missing out on this learning experience. It is also a disadvantage to the group, since it leads to an incomplete overview of the knowledge present in the group, and thus unnecessary learning goals, resulting in the risk of wasting time in the individual study of the group members.

The passive student – not writing down the learning goals:

Some students do not write down the learning goals. Stress the importance of the learning goals, and the importance of writing them down. Learning goals can be considered study assignments that the tutorial group sets itself based on the preceding discussion. Without learning goals, you run the risk of wasting time in your individual study, but you also run the risk of not being able to participate in the post-discussion, since you may have studied information irrelevant to the task at hand.

4. c) Individual study: Teaching or learning

(90 minutes)

Students have 1.5 hours scheduled for individual study, where they practice step 6 in the PBL cycle: seeking additional information outside the group from other resources. For this specific problem in the introduction, literature is provided. Explain to the students that this may not always be the case. In regular courses, step 6 may require students to find their own resources, guided by the learning goals. Introduce the students to the process of individual study, finding resources, and answering learning goals. Please refer to Appendix I (also Appendix I in the student manual) for more information and a number of points important to the concept of individual study.

Note that we provide the students with a large amount of literature. The students only have 1.5 hours, which is not enough time to read all texts. Therefore, it is necessary to stress that not every text has to be read completely and in detail. The literature should be used sensibly to answer the learning goals. We do this on purpose: it is an important skill to be able to skim through the literature to select and read only those parts that may help to answer a learning goal more extensively. During these introduction days, we do not expect students to study outside the scheduled individual study hour. In addition to the readings, students are expected to attend the lecture on educational theory.

Please note that the reading material for this task is to be handed out by the tutors at the end of the pre-discussion (PBL training session).

Provided readings:

- Boyer, E. L. (1997). Enlarging the Perspectives. In *Scholarship reconsidered: priorities of the professoriate* (pp. 571-575). Princeton, N.J.: Carnegie Foundation for the Advancement of Teaching
- Dochy, F., Segers, M., Van den Bossche, P., & Gijbels, D. (2003). Effects of problem-based learning: a meta-analysis. *Learning and Instruction*, 13(5), 533-568.
doi.org/10.1016/S0959-4752(02)00025-7
- Dolmans, D. H. J. M., De Grave, W., Wolfhagen, I. H. A. P., & Van Der Vleuten, C. P. M. (2005). Problem-based learning: future challenges for educational practice and research. *Medical Education*, 39, 732–741. doi:10.1111/j.1365-2929.2005.02205.x
- Loyens, S.M.M., & Rikers, R.M.J.P. (2011). Instruction Based on Inquiry. In R.E Mayer & P.A Alexander (Eds.), *Handbook of Research on Learning and Instruction* (pp. 361-381). New York: Routledge Press
- Savery, J. R. (2006). Overview of Problem-based Learning: Definitions and Distinctions. *Interdisciplinary Journal of Problem-Based Learning*, 1(1). doi.org/10.7771/1541-5015.1002
- Sungur, S., & Tekkaya, C. (2006). Effects of Problem-Based Learning and Traditional Instruction on Self-Regulated Learning. *Journal of Educational Research*, 99(5), 307-317. Retrieved from <http://www.jstor.org/stable/27548142>

4. d) The post-discussion: Teaching or learning

(60 minutes)

This training session consists of approximately 50 minutes of post-discussion, and approximately 10 minutes of evaluation.

The results of the individual study activities are reviewed and related back to the learning goals set in the previous tutorial. The post-discussion should be used by the students to check their own understanding and enhance their comprehension of the material. Students should explain in their own words, and make sure that the others understand what they are saying. They can use their notes to jog their memory, but should be discouraged to read out word for word. When

others speak, they should ask themselves whether they understand what others are saying, and if they believe the standpoints to be accurate.

As a tutor, you may want to actively support the discussion leader in this exercise. We expect the discussion leader to ensure that the group makes progress in working towards its tasks, to briefly introduce the subject to be dealt with, to make sure that each group member has the opportunity to make their contribution to the discussion by allowing them time to speak, and to keep an eye on the time. In addition, the discussion leader should provide structure by means of summarising progress regularly, and make sure the discussion remains focussed, ending the discussion when members stray away from the subject.

Note, *“an effective discussion leader will be interested primarily in the way the group goes to work on the problem. For preference, a discussion leader should not interfere with the content of the contributions. Experience shows that interfering with content leads to the responsibilities as discussion leader being neglected”* (Moust et al., 2017, p.61).

Please refer to Appendix I for more information on step 7.

<p><i>Some things we <u>expect</u> to see in a post-discussion:</i></p> <ul style="list-style-type: none">× <i>Students solving the learning goals</i>× <i>Everyone participating</i>× <i>Students asking for explanations</i>× <i>Students giving explanations</i>× <i>The chair providing summaries</i>× <i>If necessary, use of the board</i>	<p><i>Some things we do <u>not</u> want to see in a post-discussion:</i></p> <ul style="list-style-type: none">× <i>Students reading from the literature</i>× <i>Students looking at the tutor every time they have a doubt – solve problems as a group!</i>× <i>Students not answering the learning goals but summarising the chapter</i>× <i>Students skipping learning goals</i>× <i>Students taking minutes</i>
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What are the characteristics of PBL? *(students may want to make a comparison between PBL and a conventional lecture-based instruction)*

“PBL is an instructional (and curricular) learner-centred approach that empowers learners to conduct research, integrate theory and practice, and apply knowledge and skills to develop a viable solution to a defined problem” (Savery, 2006, p.12). The method helps to develop several skills “ including the ability to think critically, analyse and solve complex, real-world problems, to find, evaluate, and use appropriate learning resources; to work cooperatively, to demonstrate effective communication skills, and to use content knowledge and intellectual skills to become continual learners” (Savery, 2006, p.12). PBL is based on constructivism (see next learning goal), whereas traditional education is based on cognitivism, in which the teacher disseminates knowledge, resulting in an increase in the students’ memory systems (Loyens, 2011).

Characteristics (obtained from Savery, 2006, p.12-14):

- Students must have responsibility for their own learning.
- The problem simulations used in PBL must be ill-structured and allow for free inquiry.

- Learning should be integrated from a wide range of disciplines or subjects.
- Collaboration is essential.
- What students learn during their self-directed learning must be applied back to the problem with reanalysis and resolution.
- A closing analysis of what has been learned from work with the problem and a discussion of what concepts and principles have been learned are essential.
- Self and peer assessment should be carried out at the completion of each problem and at the end of every curricular unit.
- The activities carried out in PBL must be those valued in the real world.
- Student examinations must measure student progress towards the goals of PBL
- PBL must be the pedagogical base in the curriculum and not part of a didactic curriculum.

What is the constructivist view on learning?

“Constructivist theories are concerned with how people make sense of situations or, more generally, with how people create meaning and construct knowledge out of experiences” (Loyens, 2011, p.363). The essence of constructivist view on learning states that learning involves the construction of knowledge, and involves social negotiation. Learning benefits from self-regulation and learning situations similar to future professional situations (Loyens, 2011).

PBL has the potential to prepare students effectively for future learning because it is based on constructive, self-directed, collaborative and contextual learning (Dolmans, 2005).

1) Constructive learning: “learning is an active process in which students actively construct or reconstruct their knowledge networks. Learning is a process of creating meaning and building personal interpretations of the world based on individual experiences and interactions. Competence is fostered not primarily by teaching to deliver knowledge, but through teaching to stimulate specific kinds of cognitive activities” (Dolmans, 2005, p.732).

2) Self-directed learning: “learners play an active role in planning, monitoring and evaluating the learning process. Planning implies that a learner starts with considering a variety of ways to approach a task, sets a clear goal, selects strategies for achieving the goal and identifies potential obstacles to successful attainment of the goal. Monitoring implies that the learner is aware of what he or she is doing and anticipates what ought to be done next, by looking back and forward. After completion, evaluation takes place of both the process and the product of the learning process. Reflection plays an important role in the process of self-regulation” (Dolmans, 2005, p.733).

According to Moust *et al.* (2007), step 7 in PBL involves synthesising, meaning that students “try to establish a common link between the aspects that they have found in the literature” (p.34). This includes a short summary of the main points of the consulted literature, a discussion of the learning material that has not been completely understood, and a review of the pre-discussion, which should focus on whether students “are now in a better position to recognise and

understand the subject-related principles raised by the problem” (Moust *et al.*, 2007, p.34). *Note that students do not have this information.*

“The problem simulations used in problem-based learning must be ill-structured and allow for free inquiry. Problems in the real world are ill-structured (or they would not be problems)” (Savery, 2006, p.13).

3) Collaborative learning: “Collaboration is a social structure in which two or more people interact with each other and, in some circumstances, some types of interactions occur that have a positive effect. Collaboration is not a matter of division of tasks among learners, but involves mutual interaction and a shared understanding of a problem. Collaborative learning takes place when the following conditions are met: participants have a common goal, share responsibilities, are mutually dependent and need to reach agreement through open interaction. Factors within the collaborative learning situation, which may enhance learning, are elaborations, verbalisations, co-construction, mutual support and criticism, and tuning in cognitively and socially. In other words, learners should be stimulated to interact with each other because these interactions may positively influence learning” (Dolmans, 2005, p.733).

4) Contextual learning: “Learning always takes place in a context or, in other words, all learning is situated. The situation in which knowledge is acquired determines the use of this knowledge. Knowledge transfers less easily across different types of situations. However, transfer can be facilitated by anchoring learning in meaningful contexts, revisiting content at different times in rearranged contexts, for different purposes and from different perspectives” (Dolmans, 2005, p.733).

Students may come up with the definition of cognitivism, as addressed in the paper by Loyens (2011). Cognitivism is a “theoretical approach to understand the mind. This view argues that the teacher disseminates knowledge, which students absorb. The aim of instruction, according to the cognitivists, is an increase in the students’ memory systems” (Loyens, 2011, p.363).

What does an instructional method based on inquiry imply?

Instruction based on inquiry places emphasis on the learner as an active agent as opposed to being teacher-centred. PBL belongs to a ‘family’ of instructions based on inquiry, consisting of inquiry-based learning (IBL), problem-based learning (PBL), project-based learning (PjBL), and case-based learning (CBL) (Loyens, 2011).

- IBL “allows students to become familiar with particular subject matter that is introduced in the presented situation, but also learn more about the inquiry process itself” (Loyens, 2011, p.365). The core elements “consist of engaging in scientifically oriented questions, seeking evidence to find answers to these questions, developing explanations/answers to the questions that were posed, evaluating these explanations as well as the probability of alternative explanations, and communicating and clarifying their own conclusions” (Loyens, 2011, p.365).
- “In PBL, small groups of 10-12 students learn in the context of meaningful problems that describe observable phenomena or events” (Loyens, 2011, p.366). The outcome of a

PBL discussion is that students understand the problems in terms of the underlying theoretical explanations (Loyens, 2011).

- In PjBL, the learning process is organised around projects, which drive students' activities (compare to ThinkTank). "The students have a significant degree of control of the project they will work on and what they will do in the project" (Loyens, 2011, p.367).
- CBL can be considered a special form of PBL. It is a form of collaborative learning where learners are presented with a case, which are similar to problems in PBL. The difference lies in the sequence of the problem – in PBL it is the starting point; in CBL, students need to prepare in advance and can ask questions during the discussion of the case – and the way information is gathered (Loyens, 2011).

IBL and PjBL can also be carried out individually; all other formats usually imply working together with others (Loyens, 2011).

How can we define/ recognise a true scholar?

According to Boyer (1997), a true scholar can be recognised based on four functions:

- The scholarship of discovery: research – "not just the outcome, but the process, and especially the passion, give meaning to the effort" (Boyer, 1997, p.17).
- The scholarship of integration: giving meaning to isolated facts, putting them in perspective, "making connections across the disciplines, placing specialties in larger context, illuminating data in a revealing way, often educating nonspecialists, too" (Boyer, 1997, p.18). "Integration also means interpretation, fitting one's own research – or the research of others – into larger intellectual patterns" (Boyer, 1997, p.19).
- The scholarship of application: a dynamic process in which discovery may lead to application and application may lead to new discoveries (Boyer, 1997). The application of knowledge "moves toward engagement as the scholar asks, "How can knowledge be responsibly applied to consequential problems? How can it be helpful to individuals as well as institutions?" And further, "Can social problems themselves define an agenda for scholarly investigation?"" (Boyer, 1997, p.21).
- The scholarship of teaching: "the work of the professor becomes consequential only as it is understood by others" (Boyer, 1997, p.23).

Does PBL "prepare for life"? How so?

Dochy *et al.* (2003) report that the knowledge base of students in a conventional learning environment tends to be higher as compared to the knowledge base of students trained in a PBL environment. However, students in PBL tend to be better in applying their knowledge (skills). Furthermore, Sungur and Tekkaya (2006) showed that in comparison to conventionally trained students, PBL students have "higher levels of intrinsic goal orientation, task value, use of

elaboration learning strategies, critical thinking, metacognitive self-regulation, effort regulation, and peer learning” (p.307).

Dochy *et al.* (2003) conclude that “students in PBL have slightly less knowledge, but remember more of the acquired knowledge” (p.549), which can be explained by the fact that “the knowledge of students in PBL is elaborated more and, consequentially, they have a better recall of their knowledge” (Dochy, 2003, p.549). Students trained in a PBL environment Master the skills better in comparison to conventionally trained students. This positive effect is immediate and lasting (Dochy, 2003).

4. e) Evaluation of the full PBL cycle

(~10 minutes)

Evaluate the full PBL cycle of pre-discussion, individual study, and post-discussion. Pay attention to how the group and/or individual students have improved. You can use the attention points that were identified in the pre-discussion as guidance for this evaluation session. Provide the students with extensive feedback, and encourage them to give each other constructive feedback.

Check with the students if they now recognise the importance of all seven steps, and the importance of conducting the steps in the correct order. If time allows, ask them to explain the importance to you.

Evaluate the group dynamics (did everyone participate? Did all students have the chance to speak up, finish their sentence? Did people actively listen, or did people start a new topic, simply dismissing the previous speaker?). Based on the outcome of the evaluation of the group dynamics, and if time allows, you could draw up a list of ‘attention points that students can take to their tutorial meetings next week. This allows them to develop their PBL skills beyond the introduction days.

5. Materials for Students

Introduction

This is an introduction to Problem-Based Learning, an instructional method that emphasises active learning. During PBL sessions, more initiative is expected from you concerning what and when you study, and the sources you use to expand and deepen your knowledge. The tutor does not steer all of the learning activities but is primarily concerned with guiding the learning process and the group. Central to PBL is that students work in groups. In order to gain optimal benefit from the group meetings, it is important that cooperation within the group proceeds in an effective manner. Learning to work in groups also prepares you for later professional activities that frequently involve working in groups such as department teams, committees, and all kinds of other consultancy structures.

To function well as a group (and as a group member), there are a number of prerequisite skills. Some of these appear to be simple (e.g., listening, providing information, asking for information, summarizing); others are more difficult (e.g., leading a discussion, evaluating, giving feedback, receiving feedback). Therefore, we pay attention to PBL and the skills necessary for this educational method. The objective of this three-day introduction training is to help you develop these skills and manners of working necessary to function well within this learning environment.

The booklet *PBL study skills: an overview* by van Til and van der Heijden (1998), included in the introduction package, contains a concise and well-organized overview of Problem-Based Learning and the required skills. You are strongly advised to acquaint yourself with the contents of this PBL study skills booklet.

Problem-Based Learning

What follows is a quick explanation of Problem-Based Learning. Do not worry if some things are not clear to you; they will become more tangible during the PBL sessions.

- PBL has three parts:
1. the realisation that all life is problem solving;
 2. the best way to approach these problems is in the company and with the help of others eager to learn;
 3. the realisation that if you end up in a group that has to achieve an outcome in a limited time that whichever way you turn it you will go through some version of the seven steps.

The first part, the realisation that all life is problem solving translated to PBL, means that problems or tasks are ill defined. In tutorials, problems or tasks mark the starting point of the learning process. Tasks may vary in their form, structure, and presentation. You may be confronted with case descriptions, the presentation may be a written or visualised description of a situation, a graph, or a picture, it may be in the form of a conversation, or quotes from a newspaper article. However, no matter the form, a well-written PBL-task does not immediately and conclusively give away what problem needs to be discussed, that is, the problem is ill-defined.

The second part means that the success of a tutorial can only be achieved if every member of the group is prepared to contribute something towards it. You need the requisite listening skills, critical thinking skills, commitment to a group product in terms of learning objectives, etc. Problem-Based Learning means that although much of the work has to be done on your own, you will also be working with other students. It both recognises and highlights the interactive or collaborative aspects of learning: sharing resources, new ideas for explaining the problem at hand, suggesting alternative resources, which you may have overlooked on your own, are all examples of learning from and with each other.

The third part is the realisation that the seven steps are the self-evident consequence of any attempt to work in a group in a productive way. When discussing with friends or peers, you quickly realise that without having a clear sense of what the concepts are that are being used in a discussion (*step 1. clarifying unclear terms and concepts*), or without a clear sense of the topic of discussion (*step 2. defining the problem*), the discussion is by no means constructive. It is impossible to achieve a clear outcome if the participants do not share the knowledge they have on topic already, or if you have no idea about the others' perspectives on a topic (*step 3 and 4. problem analysis: producing as many ideas as possible – brainstorm – and arranging the ideas systematically – clustering*). Clearly defining problem areas or issues that ask for a solution (*step 5. formulate learning goals*), finding answers to these problems (*step 6. seek information from learning resources*), and sharing this information with the group (*step 7. Synthesis and apply the new information*) is the only true way to achieve an outcome in a limited time.

The seven-step approach

Step 1: Clarify unclear terms and concepts in the problem text

Step 2: Define the problem: What exactly needs explaining?

Step 3: Problem analysis: Produce as many ideas as possible

Step 4: Problem analysis: Arrange the ideas systematically and analyse them in depth

Step 5: Formulate learning goals

Step 6: Seek information from learning resources

Step 7: Synthesise and apply the new information

For an explanation of the seven-step approach, see Appendix I.

Problem: Teaching or learning?

A group of 12 students, a mix of regular and exchange students, sitting around a large table. They all have a booklet in front of them, titled Course Manual Educational Sciences, and they are reading the first problem description. The tutor, who is also their professor, appears to be late, but that does not stop them from starting. These students clearly have a high level of intrinsic motivation. They are convinced of the fact that all life is problem solving and that the best way to approach these problems is in the company and with the help of others eager to learn. They all support the constructivist views on learning, an instructional method based on inquiry.

Their professor is a true scholar, in line with the definition of Ernest Boyer. There is a quote by Aristotle on the wall of her office stating: "Teaching is the highest form of understanding". Their professor has a true passion for research. Her problem descriptions appeal to the students, since they include applying theories to real-life examples and situations, which helps students to see how the things they learn are relevant for their future. Although the professor only rarely partakes in the discussion, she has a tendency to give meaning to isolated facts, putting them in perspective.

The day before the exam, the students enjoy a beer together at the market square of the city. One of the exchange students compares his experiences with PBL to the lecture-based instruction method at his home university. The students are interested in the opinion of their professor on this matter, and they invite her to join them. She is a bit surprised: "Should you not be studying for the exam?" Nope, not us; we are prepared for life!

DIFFICULT WORDS:**PROBLEM STATEMENT(s):****NOTES:**

LEARNING GOALS:

Individual Study: Teaching or learning?

Your tutor will hand out the reading material for this task. Make sure to take notes during your individual study. In the post-discussion, we do not want you to read or cite from the original texts. You should use your notes and explain in your own words when reporting in the post-discussion, to allow for better retention of the studied materials.

Provided readings:

Boyer, E. L. (1997). Enlarging the Perspectives. In *Scholarship reconsidered: priorities of the professoriate* (pp. 571-575). Princeton, N.J.: Carnegie Foundation for the Advancement of Teaching

Dochy, F., Segers, M., Van den Bossche, P., & Gijbels, D. (2003). Effects of problem-based learning: a meta-analysis. *Learning and Instruction*, 13(5), 533-568.
[doi.org/10.1016/S0959-4752\(02\)00025-7](https://doi.org/10.1016/S0959-4752(02)00025-7)

Dolmans, D. H. J. M., De Grave, W., Wolfhagen, I. H. A. P., & Van Der Vleuten, C. P. M. (2005). Problem-based learning: future challenges for educational practice and research. *Medical Education*, 39, 732–741. [doi:10.1111/j.1365-2929.2005.02205.x](https://doi.org/10.1111/j.1365-2929.2005.02205.x)

Loyens, S.M.M., & Rikers, R.M.J.P. (2011). Instruction Based on Inquiry. In R.E Mayer & P.A Alexander (Eds.), *Handbook of Research on Learning and Instruction* (pp. 361-381). New York: Routledge Press

Savery, J. R. (2006). Overview of Problem-based Learning: Definitions and Distinctions. *Interdisciplinary Journal of Problem-Based Learning*, 1(1). doi.org/10.7771/1541-5015.1002

Sungur, S., & Tekkaya, C. (2006). Effects of Problem-Based Learning and Traditional Instruction on Self-Regulated Learning. *Journal of Educational Research*, 99(5), 307-317. Retrieved from <http://www.jstor.org/stable/27548142>

NOTES:

Post-discussion: Teaching or learning?

The results of the individual study activities are reviewed and related back to the learning goals set in the previous tutorial. The post-discussion should be used to check your own understanding and enhance your comprehension of the material. Explain in your own words, and make sure that the others understand what you are saying. Use your notes to jog your memory, but do not read out word for word. When others speak, ask yourself whether you understand what they are saying, and if you believe their standpoint to be accurate.

Some things we expect to see in a post-discussion:

- × *Students solving the learning goals*
- × *Everyone participating*
- × *Students asking for explanations*
- × *Students giving explanations*
- × *The chair providing summaries*
- × *If necessary, use of the board*

Some things we do not want to see in a post-discussion:

- × *Students reading from the literature*
- × *Students looking at the tutor every time they have a doubt – solve problems as a group!*
- × *Students not answering the learning goals but summarising the chapter*
- × *Students skipping learning goals*
- × *Students taking minutes*

NOTES:

Evaluation

Things you noticed, things you want to or should improve